

MEMO.

## CORRECTION OF CLERICAL ERRORS.

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SPECIFICATION. No. 11,693, A.D. 1898.

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The following two corrections are in accordance with the decision of the Chief Examiner dated the 4th day of September, 1899 :—

Page 3, line 32, *for* a “surplus of CO<sub>2</sub>” *read* “the collection of CO<sub>2</sub>.”

„ 4, „ 1, *for* “A proper periphery” *read* “A properly peripheral”

[*The word “chlorsis” in the Provisional Specification (page 1, line 26) is a printer’s error and should read “chlerosis.”*]

PATENT OFFICE,

September 19th, 1899.

17272—150—9/99 G 4891 D & S—2 (B)



N<sup>o</sup> 11,693



A.D. 1898

*Date of Application, 23rd May, 1898*

*Complete Specification Left, 23rd Feb., 1899—Accepted, 23rd May, 1899*

PROVISIONAL SPECIFICATION.

**Improved Medical Apparatus for Enabling Regular and Increased Respiratory Action in the case of various Diseases.**

I, DEMETRIUS BOGHEAN, Doctor of Medicine, of Josefstädterstrasse 55, Vienna VIII, do hereby declare the nature of this invention to be as follows:—

One of the main conditions of life is the action of the red corpuscles of the blood, which convey oxygen to the tissues and then again the proper escape of the residue of such action, the deterioration of the tissues, *viz* the carbonic acid ( $\text{CO}_2$ ). These results are mainly produced by the operation of breathing (respiration). The lungs normally lie against the inner walls of the chest and follow the motions of the latter. On the expansion of the chest, the lungs draw in air and on contraction they expel the air thus drawn in, laden with carbonic acid. If the difference of volume between the extended and contracted position of the thorax is insufficient, the air *i.e.*, amount of oxygen introduced by the inspiration will be insufficient, and the expiration thus rendered more difficult, will tend to cause the tissues to retain carbonic acid (cyanosis). If this action increases, the breathing centre will be greatly irritated, and difficulty of breathing (dyspnoea) and asthmatic symptoms will appear as for instance in the case of empysema. The heart, too, in such cases will be over-exerted in order to bring the red corpuscles of the blood more often into contact with the spare quantity of oxygen in the lungs, and thus to substitute frequency for sufficiency.

Our body is, however, often subject to a surplus of  $\text{CO}_2$  through stagnancy of the circulation owing to substantial defects of the valves of the heart (*vitia cordis*). The proper regulation of the action of breathing discharges also in such cases the action of the heart and improves the quality of the blood. Similarly, affections of the liver (cirrhosis) and kidneys (Bright's disease) produce defective circulation and irregular breathing.

On the other hand, if a sufficient supply of oxygen is not present bloodlessness (chlorosis and anæmia) will be observed, as also an incomplete oxydation in the organism in certain cases of *diabetes mellitus*, or accumulation of only partially oxydised injurious residues of the retrogressive metamorphosis of the life, such as uric acid in the case of gout (*arthritis urica*). An insufficient expansion of the chest (thoraxfixation) accompanies all those diseases of the lungs, which are the results of microbical invasion (tuberculosis pneumonia).

Finally, the breathing action is injuriously influenced by the pathological collection of fluids between the lungs and the interior walls of the chest (exsudate) whilst the proper extension of one side of the lungs is also prevented by a deformed spine (scoliosis).

The object of the apparatus forming the present invention is to heal cases of the above description, or if healing is impossible, at least to make life endurable by regulating the periods at which breath is drawn and the depth of the breathing of patients, who, in consequence of illness are not capable of breathing properly.

[Price 8d.]



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or of such who, in order to attain certain healing effects, have to be forced to a regular and higher respiratory action or to attain increased breathing capacity.

According to the invention a flexible cord or band is employed in connection with the patient, said cord or band being arranged around the chest of the patient and rhythmically tightened at equal intervals to produce the expiration and inter- 5 mittently loosened to allow of relaxation of the chest and lungs.

The band does not act directly on the body, but is employed in combination with a series of plates or cushions, which are fitted only to those regions of the body which are to be influenced as the most appropriate for the intended effect. The nature of the disease to be treated determines number, size and disposition of 10 these compressing plates.

Thus according to one form of carrying out my invention, one curved plate or cushion may be fitted to the back and sides of the patient, whilst two plates may be placed on suitable parts of the breast. All the plates or cushions are connected by means of a cord or flexible band encircling the chest and running 15 on antifriction rollers or the like mounted on the outside of the plates or cushions. The two ends of the said flexible band may be attached to a disc, which may be periodically swung or reciprocated so as to tighten and loosen the said band alternately.

I may of course increase the number of plates around the chest or arrange the 20 same in any manner according to the nature of the disease. I may also hinge some or all of the said plates or cushions together, providing each with antifriction means for supporting the flexible cord surrounding the chest and also as above mentioned means for periodically loosening and tightening the said cord.

The means for periodically contracting or drawing together the flexible band and 25 thus producing respiration, may be of any kind whatever. An electric motor is advantage, as—owing to the very small amount of power required—it may be mounted on the back plate or cushion and carried by the patient. Although any means may be employed to produce the oscillating movement of the disc to which the ends of the flexible cord are attached, I will indicate a preferred form of such 30 device. This consists of two discs mounted one on the shaft of the driving medium and the other on the shaft of the flexible band disc, the latter disc being mounted in proximity to the former but eccentrically thereto and both discs being provided on their adjacent faces with cam pins adapted to engage one with the other during a certain part of each revolution of the motor disc. Thus owing to the eccentric 35 arrangement of the band disc to the motor disc its cam pin will slide, out of engagement with the cam pin of the motor disc at a certain point of each revolution of the latter. As soon as this takes place the cord or band will be released and the said band will be returned, by the inspiration of the patient, to its initial position and as the cam pin of the motor disc comes round again it will engage the 40 band cam pin and take the same round again a certain distance causing expiration. Suitable stops may be employed to arrest the band disc in its proper position. If an electromotor is employed it may be connected by means of wires to any suitable source of electricity. The wires may be long enough to allow the patient sufficient room for movement. In the event of a number of patients being supplied with 45 electricity in a limited space—for instance for walking exercise—the motor of each patient may be connected by conductor wires to overhead conductors in the well known manner.

From the above description it will be clear that the plates or cushions may be adapted to any disease, according to requirement, their shape and the pressure 50 of the cord thereon being variable to the finest degree. The periods of inspiration and expiration may be varied at will by varying the number of revolutions made by the driving motor.

The depth of the breath taken will be determined by the periods of engagement of the motor disc with the flexible band disc, which also regulates the periods of 55 respiration.

One feature of the invention consists in not connecting the cord or band direct to



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the plates or cushions, but in allowing the same to run on antifriction rolls mounted on the said plates. I have stated that the motor is advantageously mounted on one of the back plates, but it may be mounted anywhere as long as the conditions stated are complied with.

5 Dated this 23rd day of May 1898.

CASTLE SMITH,  
 "Invention" Office, Mitre Court, Fleet Street, London, E.C.  
 Agent for the Applicant.

## COMPLETE SPECIFICATION.

10 **Improved Medical Apparatus for Enabling Regular and Increased  
 Respiratory Action in the case of various Diseases.**

I, DEMETRIUS BOGHEAN, Doctor of Medicine, of No. 55, Josefstädterstrasse, Vienna VIII, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and  
 15 by the following statement:—

One of the main conditions of life is the action of the red corpuscles of the blood, which convey oxygen to the tissues and then again the proper escape of the residue of such action, the deterioration of the tissues, *viz.* the carbonic acid ( $\text{CO}_2$ ). These results are mainly produced by the operation of breathing  
 20 (respiration). The lungs normally lie against the inner walls of the chest and follow the motions of the latter. On the expansion of the chest, the lungs draw in air and on contraction they expel the air drawn in, laden with carbonic acid. If the difference of volume between the extended and contracted position of the thorax is insufficient, the air *i.e.* amount of oxygen introduced by the  
 25 inspiration will be insufficient, and the expiration thus rendered more difficult, will tend to cause the tissues to retain carbonic acid (cyanosis). If this action increases, the breathing centre will be greatly irritated, and difficulty of breathing (dyspnoea) and asthmatic symptoms will appear as, for instance, in the case of empysema. The heart, too, in such cases will be over-exerted in order to bring the corpuscles  
 30 of the blood more often into contact with the spare quantity of oxygen in the lungs, and thus to substitute frequency for sufficiency.

The body is, however, often subject to a surplus of  $\text{CO}_2$  through stagnancy of the circulation owing to substantial defects of the valves of the heart (*vitia cordis*). The proper regulation of the action of breathing discharges also in such  
 35 cases the action of the heart and improves the quality of the blood. Similarly, affections of the liver (cirrhosis) and kidneys (Bright's disease) produce defective circulation and irregular breathing.

On the other hand, if a sufficient supply of oxygen is not present, bloodlessness (chlorosis and anæmia) will be observed, as also an incomplete oxydation in the  
 40 organism in certain cases of *diabetes mellitus*, or accumulation of only partially oxydised, injurious residues of the retrogressive metamorphosis of the life, such as uric acid in the case of gout (*arthritis urica*). An insufficient expansion of the chest (thoraxfixation) accompanies all those diseases of the lungs, which are the results of microbical invasion (tuberculosis pneumonia).

45 Superficial respiration resulting from defect impulses of the centre of breathing and concomitant weakened action of the heart is also observable in various nerve and brain affections combined with psychical depression (neurastenia, traumatic



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neurosis, melancholy, acute dementia, circular insanity *etc.*). A proper periphery and as far as possible permanent regulator for the depth and frequency of respiration would obviate the pathological consequence of the defective central innervation would improve the chemical quality of the blood by increasing of the CO<sub>2</sub>, resuscitate the action of the heart, provided the exhausted central nervous organs with more 5 and better blood and would prevent the invasion of microbes in the lungs (tuberculosis) which often occurs in such cases of disease.

Then again the breathing action is injuriously influenced by the pathological collection of fluids between the lungs and the interior walls of the chest (exsudate) whilst the proper extension of one side of the lungs is also prevented by a deformed 10 spine (scoliosis).

Finally, an apparatus which will work automatically for hours and may be adjusted to suit all and any particular requirements, for regulating the breathing has hitherto been wanting for purposes of saving life, in cases of intoxication (chloroform narcosis, carbonic oxide poisoning *etc.*) or for producing the first 15 breathing of children at birth.

The object of the apparatus forming the present invention is to heal cases of the above description, or if healing is impossible, at least to make life endurable by regulating the periods at which breath is drawn and the depth of the breathing of patients, who, in consequence of illness are not capable of breathing properly, 20 or of such who, in order to attain certain healing effects, have to be forced to a regular and higher respiratory action.

The apparatus is illustrated in the accompanying drawing and consists of a series of soft, flexible compression plates  $b^1 b^2 \dots b^x$ , which are connected together and fitted to the proper parts of the body (Figs. 1 to 3). A flexible band or cord is 25 guided over rolls of the said plates as at  $a$ , said cord not coming into direct contact with the body at any point. By means of mechanical power supplied from a motor suitably mounted at any desired place, this cord is caused to perform rhythmic contraction and expansions, so that the plates only cause the pressure during each respiration, thus regulating the length of expiration and inspiration plus the 30 proper pause. The arrangement of the plates enables the pressure to be applied to those parts of the chest only, which are necessary in order to attain the desired healing effect, and thus to properly distribute the pressure, which is impossible with a simple band, having no compression plates. The number size and arrangement of the plates should be chosen according to circumstances. 35

In Figs. 1 to 3 three different forms of compression plates are illustrated: in Fig. 1 the cord operates two plates  $b^1$  and  $b^2$  which are free to move in any direction. In Fig. 2 the two plates are subdivided into several lamels  $b^1$  to  $b^4$  and  $b^5$  to  $b^8$ . According to Figure 3 two pressure plates  $b^1$  and  $b^3$  are employed which are capable of turning on hinges  $s^1$  and  $s^2$ , being hinged to a third plate  $b^2$  which 40 does not lie on the chest in this case, but is provided with suitable supports in the neighbourhood of the collar bone and the hips, so that no pressure is caused on the breast bone.

According to Fig. 4 the central part of the cord  $a$  is guided over rolls  $R^1$  to  $R^4$  to a swinging lever  $H^1$  pivoted at  $O^1$ , said lever being reciprocated by means of a 45 cam disc  $u$  mounted on a shaft  $f$ . The latter is rotated by means of any suitable motor always in one and the same direction. To lessen the friction the lever  $H^1$  is provided with a roll  $r^1$  and in order to render the adjustment of the stroke of the apparatus possible the said cord is attached to the lever  $H^1$  by means of a clamp  $T$ . 50

In Fig. 4 a device is illustrated by means of which the extent of the compression may be exactly regulated. This device consists of a roll  $R^4$  mounted on a lever  $H$  pivoted at  $O$  and this lever may be adjusted to any desired position by means of a screw  $s$ , which may be turned by the patient from the outside of the apparatus. This device enables the cord to be tightened up and the length of the said cord 55 may be varied by means of buckles or the like inserted therein. The circumference of the cam disc  $u$  is constructed to suit the normal breathing capacity, the length



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of the cam surface being in proportion to the entire circumference of the disc as the length of the expiration is to the entire respiration period.

In Figs. 5 and 6 a device is illustrated by means of which the requirements may be fulfilled by two crank pin discs K and G provided that the proper diameter  
5 and excentricity of the same are chosen.

According to this construction the ends of the cord *a* are attached to a drum *e* keyed to a shaft *d*, the said cord being wound on or off the drum according to the direction or rotation of the same. The shaft *d* is turned by means of a suitable motor with a constant angular velocity, and the motion is derived from the shaft *f*,  
10 in that the latter is coupled to the former for a certain part of a revolution—*i.e.* during the period of expiration, and then released. In order to effect the coupling and uncoupling of the shafts *d* and *f* crank discs *g* and *h* are keyed to each shaft respectively, the said shafts being supported eccentrically to each other. The discs are of varying diameter and the pins are placed in the same at varying or  
15 different radii. The disc *h* turns constantly in the same direction and thus the pin of the same will couple with the crank pin of the disc *i* during a certain part of each revolution and will release the same during the remainder of each revolution. A stop *l* is provided for the pin *g* which will be returned to the said stop by the inspiration of the patient and consequent expansion of the cord. The said disc  
20 may however be returned to its initial position by means of a spiral spring which may be arranged in any suitable manner. The arc *x—y* (Fig. 6) during which the two crank pins are in engagement corresponds to the period of expiration or breathing out, the rest of the revolution to the inspiration or drawing in of breath.

By altering the number of revolutions of the apparatus or motor the periods of  
25 inspiration and expiration may be adjusted to suit the requirements of the case.

The mechanism for regularly tightening and loosening the cord is enclosed in a housing *z* (Figs. 1—4). The back plate *b*, which is advantageously rigid, encloses the back and part of the sides of the patient. This housing may also contain an electro motor if desired, and in cases in which the motor is not simultaneously  
30 employed to operate several apparatuses. If the apparatus is provided with its own motor the connection between the shafts *f* and *d* is effected by means of a cord or gear wheel mechanism by means of which the high speed of the motor is correspondingly reduced. The motor may be controlled by a centrifugal governor adapted to switch in or out suitable resistances or to effect short circuiting in the  
35 known manner or may be otherwise rendered constant and adjusted to the required speed.

Any suitable motor may be employed for operating the device. Electric motors, mounted in the apparatus appear well adapted for the purpose owing to the small amount of power required, *viz.*, one and a half to two and a third foot-  
40 pounds. The electromotor may be connected to the source of electricity by means of flexible conductors of any desired length so that the patient may have a certain amount of free movement. If several patients occupy the same space the apparatuses may be connected to the main conductors by means of runners or trolleys as in the case of electric cars, which may run along overhead wires.

The apparatus may also be driven from the axle of a chair for invalids or from that of any vehicle employed by the patient for the purpose of locomotion, in that the motion of the axle is transmitted to the apparatus by mean of gearing and a flexible shaft or in any other suitable manner. By means of the apparatus, the amount of air breath out is increased, particularly at the lower part of the  
50 rib (*regio hypochondriaca, regio inframammalis*) owing to the increased pressure and consequently decreased volume, so that the amount of carbonic acid given off is increased and the quantity of the residual air decreased. The compression of the thorax increases the difference of volume between the air drawn in by inspiration and that exhausted or forced out at the expiration and consequently necessitates an  
55 increase of volume of the air drawn in at the next following inspiration and consequently an increase of the amount of oxygen inhaled. This means an increase in the exchange of gas and consequently increased vital capacity.



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Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1:—Apparatus for mechanically regulating the period and depth of breathing in connection with patients either unable to breath properly or requiring an increased breathing capacity in order to attain certain cures, characterised by a series of pressure plates adapted to the form of the body and means for rhythmically moving the same and increasing the pressure of the same on the body to regulate the depth and period of inspiration and expiration substantially as described. 5

2:—An apparatus according to Claim 1 in which the band or cord encircling the body is connected to a lever ( $H^1$ ), reciprocated by means of a cam disc ( $u$ ) rotated by means of a suitable motor, substantially as described. 10

3:—Apparatus according to Claim 1 characterised by a drum ( $e$ ) to which the ends of the band or cord ( $a$ ) are attached, and by a shaft ( $f$ ) mounted eccentrically to the shaft ( $d$ ) of the drum ( $e$ ) and driven by a suitable motor, and by crank pin discs ( $k i$ ) with crank pins ( $i g$ ) adapted to contact and couple the said discs during a part of each revolution said drum shaft ( $d$ ) being returned to a suitable stop after each release from the constantly rotating shaft ( $f$ ) either by means of the inspiration of the patient or by a spring or the like substantially as described. 15

Dated this 23rd day of February 1899.

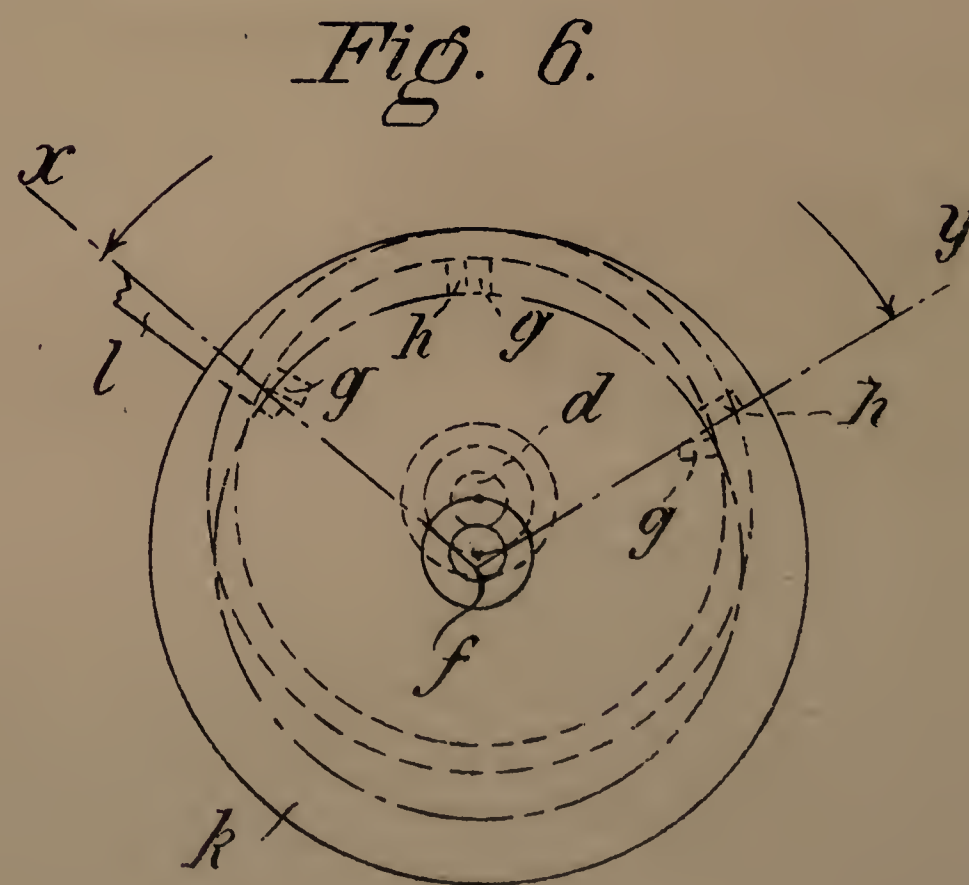
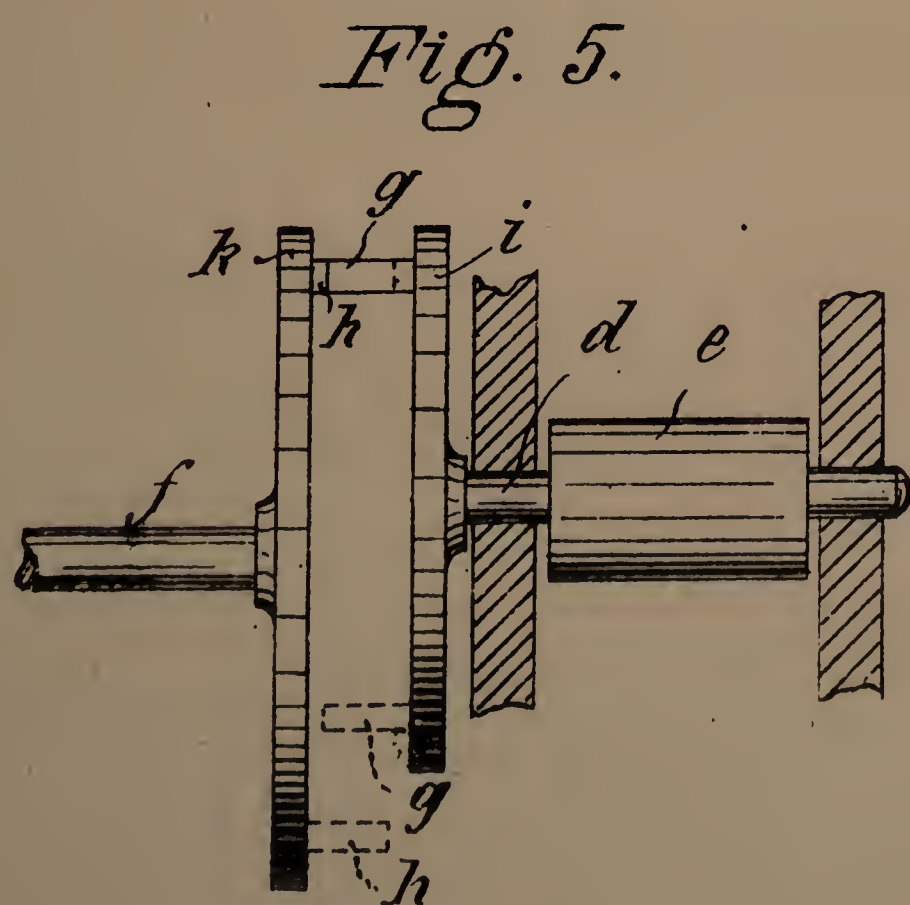
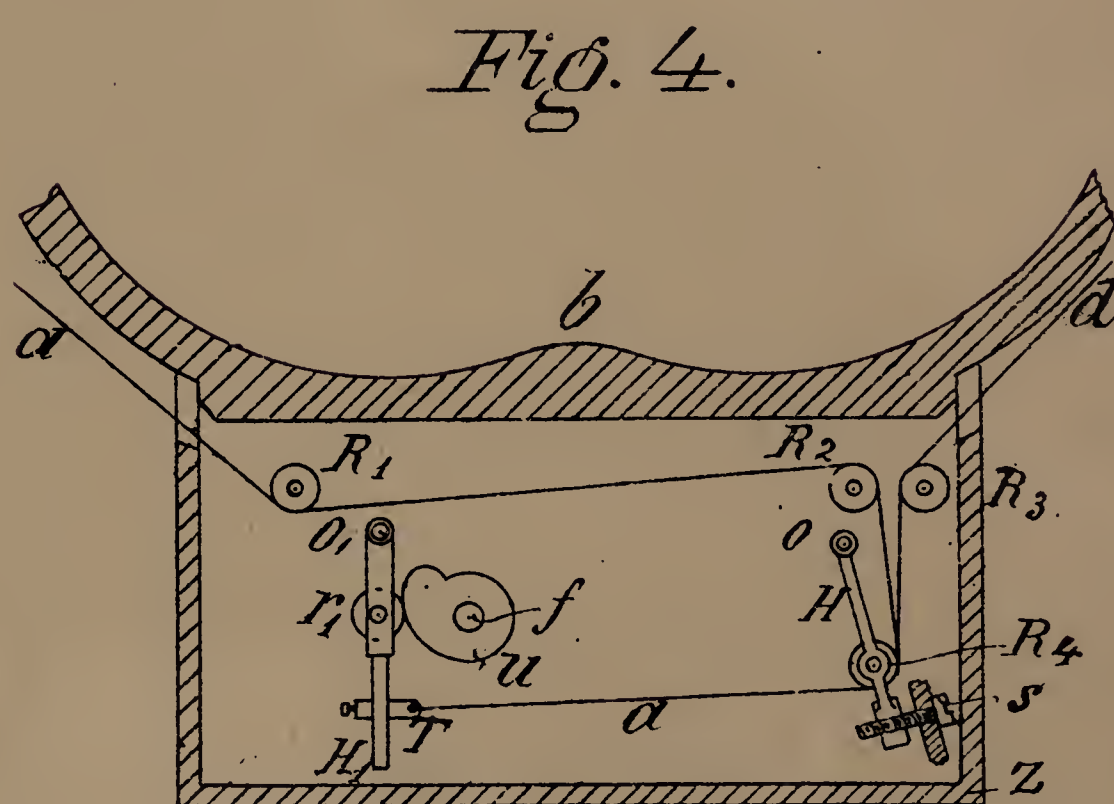
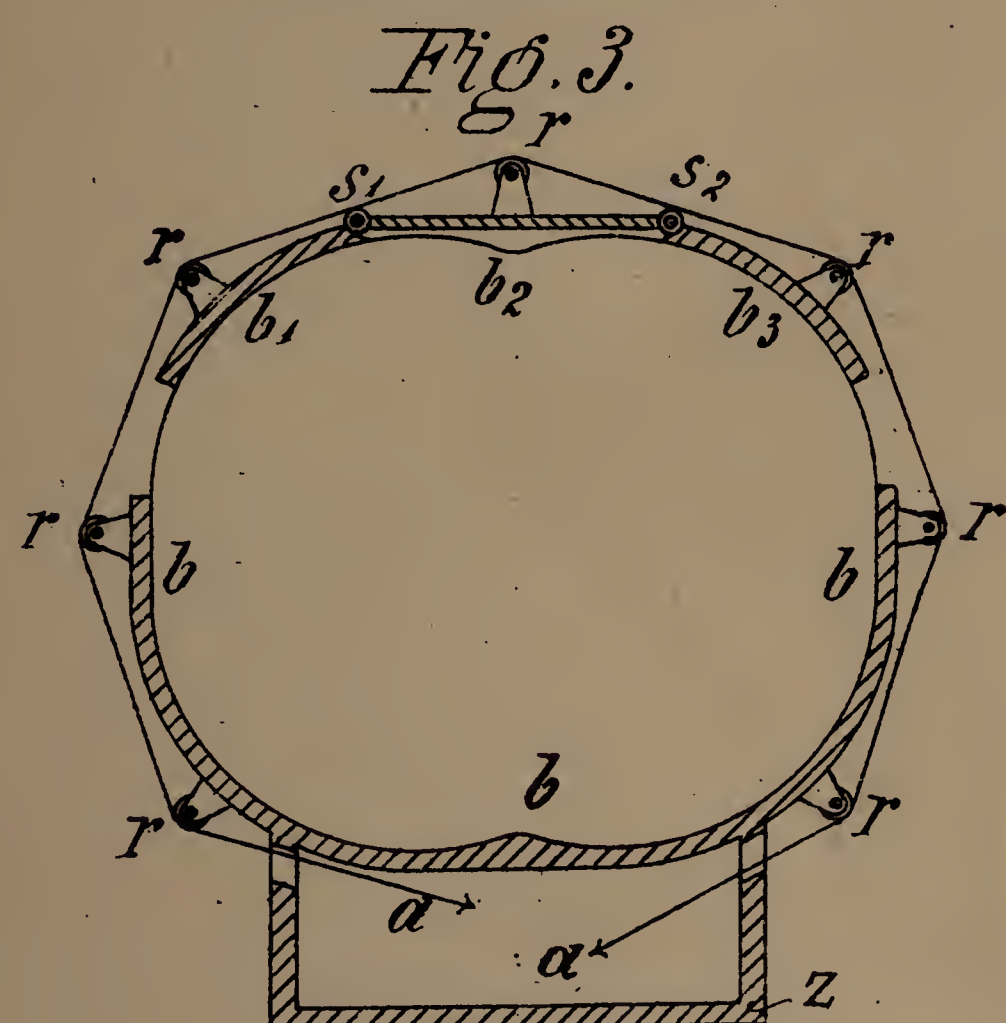
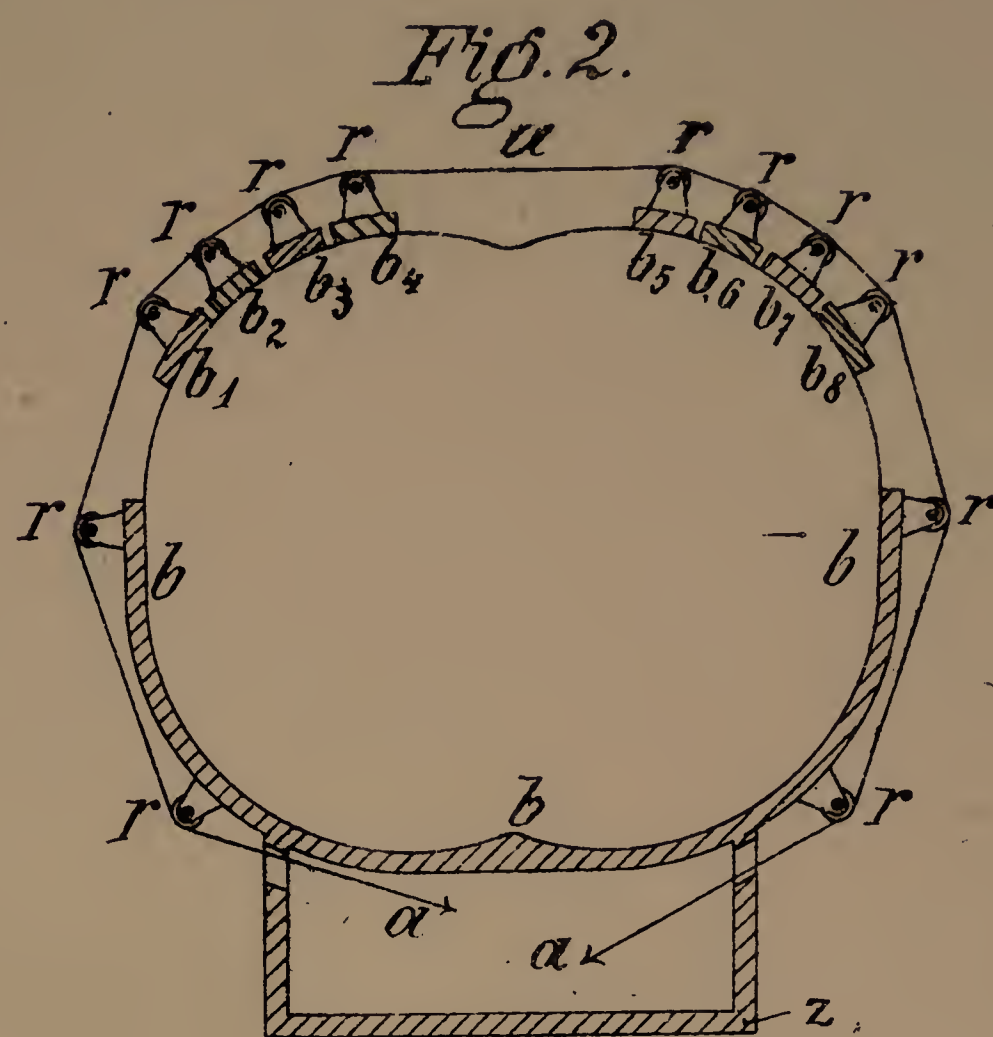
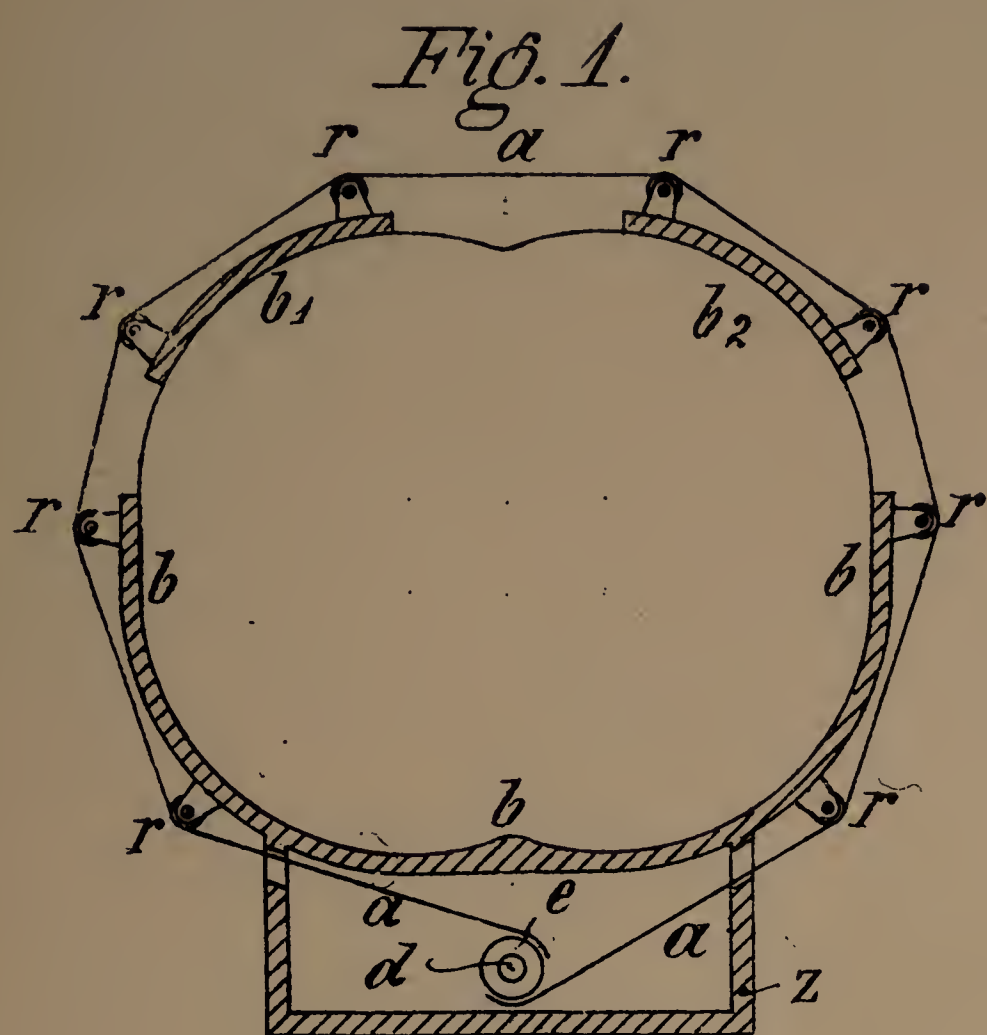
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Agent for the Applicant.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1899.







[This Drawing is a reproduction of the Original on a reduced scale.]

